Fact Sheet

A collaborative effort between the Air Force Institute for Operational Health, the Deployment Health Clinical Center,the Deployment Health Support Directorate, the Navy Environmental Health Center and the U.S. Army Center for Health Promotion and Preventive Medicine

Tungsten/Nickel/Cobalt Alloy Study

Information for Servicemembers and their Families

April 27, 2005

Summary

- The results of the Armed Forces Radiobiology Research Institute's (AFRRI) study, "Embedded Weapons-Grade Tungsten Alloy Shrapnel Rapidly Induces Metastatic High-Grade Rhabdomysarcomas in F344 Rats," released on February 15, 2005 by Environmental Health Perspectives (EHP-in-Press) indicate that rats implanted with a tungsten alloy pellet containing tungsten, nickel, and cobalt developed tumors at the implantation site (leg muscle) which then spread to the lungs.
- The AFRRI study is a first step in researching the health effects of tungsten alloy exposures, and the results should not be viewed as conclusive. Results in rats should not be generalized to predict the effects in humans who may suffer injuries from tungsten alloy munitions. Some chemicals that cause cancer in rats do not cause cancer in humans. More research is needed.
- A limited number of metal fragments removed from our soldiers in Iraq have been analyzed to determine their content. None of the fragments removed have contained tungsten or tungsten alloys as of the date of this factsheet.
- Depleted uranium (DU) pellets were also implanted in rats as part of this study. DU pellets did not cause tumors in the rats.

What is tungsten?

Tungsten is a naturally occurring metal. Tungsten can be used in pure form or mixed with other metals to make alloys. Tungsten alloys tend to be strong, flexible, and resistant to wear. Tungsten and its alloys are used in a variety of commercial products including light bulb filaments, x-ray tubes, welding electrodes, grinding wheels, ceramic pigments, and fire retardants.

Low concentrations of tungsten are occasionally used as a component in Federal Drug Administration-approved medical implants such as artificial hips and knees. Numerous countries have used tungsten and various tungsten alloy munitions for a number of years because of its high density and resulting penetrating power for armor piercing rounds.

Why was this tungsten/nickel/cobalt alloy study conducted?

After the Gulf War, DoD realized that embedded fragments such as shrapnel resulting from combat operations were a unique exposure where the long-term health effects were not fully understood. Therefore, a series of medical investigations were funded to look specifically at embedded depleted uranium fragments. At that same time, DoD decided to include a tungsten/nickel/cobalt alloy, one of the alternatives to depleted uranium (DU) already in use, in the AFRRI study.

What did AFRRI find in their study?

AFRRI's four-year study examined the effects of embedded DU and tungsten alloy pellets. AFRRI found implanted DU pellets did not produce cancer when placed in the leg muscles of rats. Both the tungsten alloy and nickel pellets caused tumor formation around the pellets. The tumors associated with the embedded tungsten/ nickel/cobalt alloy fragments quickly spread to the lungs. The tumors from the pure nickel fragment did not spread to the lungs. The rate of growth of these tumors depended on the dose level (e.g. with greater numbers of pellets, tumors developed more quickly). Embedded pellets of pure tantalum (an inert control metal) did not cause any tumors. It is currently unknown whether the individual metals in the alloy (e.g. tungsten, nickel, or cobalt) or a combination of two or more of the individual metals are responsible for causing the tumors.

What do the results mean?

The health effects of tungsten/nickel/cobalt alloy pellets warrant further investigation, and it is too early to draw definitive conclusions from the results. Scientific research has shown that some chemicals that cause cancer in rats do not cause cancer in humans. For this reason, one study in rodents is not enough evidence to indicate that people will or will not develop cancer as a result of embedded fragments. More research is needed to see if similar effects might be expected in humans.

DoD is considering a number of follow-on research proposals. These include:

- A confirmation study of AFRRI's initial research by conducting the same study in another laboratory and comparing the results.
- A similar study in a second type of laboratory animal. If there are similar results, then it is more likely that these health effects could be expected in people.
- Related studies with a different tungsten alloy.

A peer review medical research committee is currently reviewing several research proposals. It is premature to predict which studies will receive approval and funding. In addition, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) is conducting an exploratory implant study using tungsten/nickel/cobalt and tungsten/nickel/iron.

Have any servicemembers in Operation Enduring Freedom or Operation Iraqi Freedom been injured with metal fragments containing tungsten alloys?

At this time, there is no evidence of injury from metal fragments containing tungsten alloys. As a precaution, some metal fragments removed from our soldiers have been analyzed to determine their content. As of this date, none of the fragments removed have contained tungsten or its alloys.

Are there tungsten alloys in the Army's "green bullet"?

The "green bullet" is a common term for the lead-free, small arms ammunition developed by the Army in an effort to provide soldiers with ammunition that is environmentally friendly. Tungsten alloys are not used in the "green" or lead-free bullet. "Green" bullets typically contain tungsten that is mixed together with either nylon or tin. Tungsten alloys, on the other hand, contain other metals, such as nickel, cobalt, iron, or copper, which are heated to high temperature that allows the materials to bond together. While the "green" bullet has been used in training operations at a limited number of Army installations, it has not been used on the battlefield.

Why is the Army now saying that tungsten might be harmful, when you said a few years ago that it wasn't?

Initial assessments of tungsten were based on reviews of the scientific literature available at the time it was evaluated. No information was available on the adverse effects of the embedded tungsten alloy fragments or the pellets that were used in the AFRRI research.

How can I learn more about the study that was performed by AFRRI?

You can contact the Public Affairs Office at the Armed Forces Radiobiology Research Institute at (301) 295-1953. An abstract and the full-text of the *Environmental Health Perspectives* article: "Embedded weapons-grade tungsten alloy shrapnel rapidly induces metastatic high-grade rhabdomyoscarcomas in F344 rats" can be found at: http://ehp.niehs.nih.gov/docs/2005/7791/abstract.html

For specific technical questions on this study contact the DoD Health Affair's Deployment Health Support Directorate or AFRRI's Public Affairs Office. For specific military service-related issues with tungsten alloy policies, operations, and health issues, contact the service POCs listed in the box below. For general background information on tungsten contact ATSDR.

Where Do I Get More Information?

Armed Forces Radiobiology Research Institute (AFRRI)
Phone: (301) 295-1953
Email: PAO@AFRRI.USUHS.mil

DOD Deployment Health Clinical Center (DHCC)
Phone: (866) 559-1627
http://www.pdhealth.mil/

DOD Deployment Health Support Directorate (DHSD)
Phone: (800) 497-6261
http://www.deploymentlink.osd.mil

Navy Environmental Health Center (NEHC)
Phone: (757) 953-0700
http://www-nehc.med.navy.mil

Agency for Toxic Substances and Disease Registry (ATSDR)
http:/www.atsdr.cdc.gov/tfacts186.html

U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM)
Phone: (800) 222-9698
http://chppm-www.apgea.army.mil

Air Force Institute for Operational Health (AFIOH)
Phone: (888) 232-3764
http://www.brooks.af.mil/afioh/